

LISTING OF CLAIMS

1. (Currently Amended) A frequency beamsplitter for us in the frequency basis, wherein a pair of input photons are separated in frequency space by radio or microwave frequencies, comprising: an asymmetric two-path interferometer, reversible down to the quantum limit, a first partially transmitting mirror to split photons into first and second paths, a time delay element to introduce a differential time delay into the second path such that a pair of input photons are separated, by the time delay element, in the frequency space by the radio or microwave frequencies, and a second partially transmitting mirror to mix the two paths again to form two outputs.

2. (Original) A frequency beamsplitter according to claim 1, wherein the interferometer has a frequency dependent phase shift.

3. (Original) A frequency beamsplitter according to claim 2, wherein the interferometer is a Mach-Zehnder interferometer.

4. (Withdrawn) A frequency beamsplitter according to claim 2, wherein the interferometer is a Michelson interferometer.

5. (Currently Amended) A frequency beamsplitter according to [any preceding] claim 1, wherein, additional mirrors are provided between the partially transmitting mirrors or at the output to redirect the first and second paths to provide the outputs at convenient locations.

6. (Currently Amended) A frequency beamsplitter according to [any preceding] claim 1, comprising mirrors and a time delay implemented using optical fibre structures.

7. (Currently Amended) A frequency beamsplitter according to [any one of claims 1-5] claim 1, comprising mirrors and a time delay implemented using planar waveguide structures.

8. (Currently Amended) A frequency beamsplitter according to [any preceding] claim 1, arranged to operate with single photons.

9. (Currently Amended) A radio frequency half-wave for use in the frequency basis, comprising a frequency beamsplitter according to [any one preceding] claim 1, to split a beam of photonic qubits encoded in different frequency modes, an acousto-optic modulator driven to receive the outputs from the frequency beamsplitter and couple of two different frequency and spatial modes of the outputs together via a phonon interaction to produce two further outputs, a frequency beamsplitter according to [any preceding] claim 1, operating in reverse to receive the two further outputs from the acousto-optic modulator and produce a combined output.

10. (Original). A radio frequency half-wave plate according to claim 9, wherein a single frequency beamsplitter is used, operating in one direction and in reverse.